

What is claimed is:

1. A semiconductor device manufacturing method comprising the steps of:

(a) forming an interconnection (61) in a surface of an insulating layer (2) provided on a semiconductor substrate (1);

5 (b) selectively removing said insulating layer to form a first opening (80) that exposes said semiconductor substrate;

(c) after said step (b), forming, over said insulating layer, a sacrificial layer (4) having a second opening (81) that exposes a center portion of said interconnection and a third opening (83) that includes said first opening and is larger than said first opening;

10 (d) forming a conductive semiconductor (5) all over the structure obtained in said step (c);

(e) forming a first mask (301) on said conductive semiconductor;

(f) etching said conductive semiconductor using said first mask to form a first electrode (51) connected to said interconnection;

15 (g) forming a conductive film (9) all over the structure obtained in said step (f);

(h) selectively removing said conductive film to form a second electrode (90) in contact with said semiconductor substrate in said first opening; and

(i) removing said sacrificial layer.

20 2. The semiconductor device manufacturing method according to claim 1, further comprising, conducted between said step (b) and said step (c), the step (j) of forming an insulating film (3) that exposes the center portion of said interconnection and a center portion of said first opening,

25 wherein said sacrificial layer exposes edges of said insulating film on said interconnection.

3. The semiconductor device manufacturing method according to claim 1,
wherein said step (e) comprises the steps of:

(e-1) forming an oxide film (301) on said conductive semiconductor;

5 (e-2) forming a photoresist (302) covering an area where said first electrode is
to be formed; and

(e-3) etching said oxide film using said photoresist as a second mask to form
said first mask.

10 4. The semiconductor device manufacturing method according to claim 1,
wherein said interconnection has a surface that is nearly level with the surface of said
insulating layer.

5 5. The semiconductor device manufacturing method according to claim 1,
15 wherein said first electrode functions as a fixed electrode of an acceleration sensor and
said second electrode functions as a substrate electrode of said acceleration sensor.

6. A semiconductor device manufacturing method, comprising the steps of:

(a) forming an insulating layer (2) on a surface of a semiconductor substrate (1)

20 having a locally projecting raised portion (1a), which is exposed by said insulating layer ;

(b) forming an interconnection (61) in a surface of said insulating layer (2);

(c) forming, over said insulating layer, a sacrificial layer (4) having a first
opening (81) that exposes a center portion of said interconnection and a second opening
(83) that exposes a center portion of said raised portion;

25 (d) forming a conductive semiconductor (5) all over the structure obtained in

said step (c);

(e) forming a first mask (301) on said conductive semiconductor;

(f) etching said conductive semiconductor using said first mask to form a first electrode (51) connected to said interconnection;

5 (g) forming a conductive film (9) all over the structure obtained in said step (f);

(h) selectively removing said conductive film to form a second electrode (90) in contact with said raised portion; and

(i) removing said sacrificial layer.

10 7. The semiconductor device manufacturing method according to claim 6, wherein said step (a) comprises the step (a-1) of forming said raised portion on said surface of said semiconductor substrate.

15 8. The semiconductor device manufacturing method according to claim 6, further comprising, conducted between said step (b) and said step (c), the step (j) of forming an insulating film (3) that exposes the center portion of said interconnection and the center portion of said raised portion,

wherein said sacrificial layer exposes edges of said insulating film above said interconnection and above said raised portion.

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9. The semiconductor device manufacturing method according to claim 6, wherein said step (e) comprises the steps of:

(e-1) forming an oxide film (301) on said conductive semiconductor;

(e-2) forming a photoresist (302) covering an area where said first electrode is

25 to be formed; and

(e-3) etching said oxide film using said photoresist as a second mask to form said first mask.

10. The semiconductor device manufacturing method according to claim 6,
5 wherein said interconnection has a surface that is nearly level with the surface of said insulating layer.

11. The semiconductor device manufacturing method according to claim 6,
wherein said first electrode functions as a fixed electrode of an acceleration sensor and
10 said second electrode functions as a substrate electrode of said acceleration sensor.

12. A semiconductor device manufacturing method, comprising the steps of:

(a) forming an insulating layer (2) on a semiconductor substrate (1);

(b) forming, over said insulating layer, a first sacrificial layer (4) having a first
15 opening (83);

(c) forming a first electrode (51, 53c) on said sacrificial layer;

(d) forming a second sacrificial film (11) all over the structure obtained in said
step (c);

(e) etching back at least said second sacrificial film;

20 (f) covering the structure obtained in said step (e) with a photoresist (305)
having a second opening (86) that opens inside said first opening;

(g) etching said second sacrificial film using said photoresist as a mask;

(h) forming a second electrode (90) in contact with said semiconductor
substrate in an area opened in said step (g); and

25 (i) removing said first sacrificial layer and said second sacrificial layer.

13. The semiconductor device manufacturing method according to claim 12, wherein said step (e) comprises the step (e-1) of forming an insulating film (12) all over the surface after the etch-back of said second sacrificial film.

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14. The semiconductor device manufacturing method according to claim 12, wherein said step (h) comprises the steps of:

(h-1) etching said insulating layer in the area opened in said step (g) to expose said semiconductor substrate;

10 (h-2) forming a conductive film (9) all over the structure obtained in said step (h-1); and

(h-3) selectively removing said conductive film to form said second electrode.

15 15. The semiconductor device manufacturing method according to claim 12, wherein said first electrode functions as a fixed electrode of an acceleration sensor and said second electrode functions as a substrate electrode of said acceleration sensor.

16. A semiconductor device manufacturing method, comprising the steps of:

(a) forming an insulating layer (2) on a semiconductor substrate (1);

20 (b) forming, over said insulating layer, a first sacrificial layer (4) having a first opening (83);

(c) forming, on said sacrificial layer, a first electrode (51, 53c) and a dummy body (54) between said first electrode and said first opening;

25 (d) forming a photoresist (307) on the structure obtained in said step (c), said photoresist having a second opening (86) that opens inside said first opening;

(e) etching said insulating layer using said photoresist as a mask to expose said semiconductor substrate;

(f) forming a second electrode (90) in contact with said exposed semiconductor substrate; and

5 (g) removing said sacrificial layer.

17. An acceleration sensor comprising:

a semiconductor substrate (1);

an insulating layer (2) provided on said semiconductor substrate;

10 a fixed electrode (51) provided above said insulating layer; and

a substrate electrode (90) in contact with said semiconductor substrate;

said semiconductor substrate having a raised portion (1a) in contact with said substrate electrode;

said insulating layer exposing a top surface of said raised portion;

15 said substrate electrode being in contact with said semiconductor substrate on said top surface of said raised portion.

18. An acceleration sensor comprising a fixed electrode (51) and a movable electrode (53) in which a distance between said fixed electrode (51) and said movable

20 electrode (53) is $4\mu\text{m}$ or less.